

## **X-Rays, Radiation Exposure and Cancer**

Cancer is now the leading cause of death in adults under age 80 in the United States. The lifetime risk of cancer is 1 in 3 for U.S. women and 1 in 2 for U.S. men.<sup>1</sup>

The incidence of breast cancer and brain cancer is rising at an alarming rate. Breast cancer is the most commonly diagnosed cancer among women in California and in the United States. Brain tumors are the leading cause of solid tumor death in children under age 20, surpassing acute lymphoblastic leukemia (ALL).<sup>2</sup>

Each year in California:

- Approximately 25,000 women will be diagnosed with breast cancer and 4,000 will die from it.
- Approximately 2,000 people will be diagnosed with brain cancer and 1,360 will die from it.

Exposure to radiation—such as x-rays, scans, and other radiologic procedures—is contributing to these increasing rates. Although diagnostic radiation is valuable in the practice of medicine and dentistry today, patients have the right to know that procedures involving exposure to radiation involve risks as well as benefits.

In 2005, the National Toxicology Program classified x-radiation and gamma-radiation as *known human carcinogens*, stating that “exposure to these types of radiation causes many types of cancer including leukemia and cancers of the thyroid, breast and lung.”<sup>3</sup> Therefore, minimizing unnecessary or inappropriate exposure to radiation from medical and dental radiologic procedures is essential

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<sup>1</sup> American Cancer Society (2005). Cancer Facts and Figures 2005. [www.cancer.org](http://www.cancer.org)

<sup>2</sup> CA: A Cancer Journal for Clinicians. January/February 1999; 49(1):23.

<sup>3</sup> National Institute of Environmental Health Sciences. (2005). List of Cancer-Causing Agents Grows. NIEHS PR#05-01, January 31, 2005. [www.niehs.nih.gov/oc/news/cancneragents.htm](http://www.niehs.nih.gov/oc/news/cancneragents.htm)

to reducing the risk of cancer. Strengthening legislation to educate the professionals and the public about radiation risk and how to reduce exposure is a major step toward preventing cancer.

### **What is the connection between radiation exposure and cancer?**

Radiation is both a mutagen (causing genetic mutation) and a carcinogen (causing cancer). Radiation can also enhance the ability of hormones or other chemicals to cause cancer. Research shows that many consumer products such as personal care products and cleaning products contain chemicals linked to cancer, making radiation's mutagenic and carcinogenic actions cause for concern.

### **What is the evidence linking radiation exposure to breast cancer?**

Between 1950 and 1991, the incidence of breast cancer in the United States increased by 90 percent.<sup>4</sup> In the 1940s, a woman's lifetime risk of breast cancer in the U.S. was one in 22. Today the risk is one in seven and rising. Less than 10 percent of breast cancer cases occur in women with genetic predisposition for the disease.

Exposure to ionizing radiation is the best-established cause of human breast cancer. Decades of research have linked radiation exposure and breast cancer. For example:

- Women who had multiple x-rays before age 20 to monitor scoliosis treatment had a risk of breast cancer relative to the amount of exposure they received. Those who had 50 or more exposures were four times as likely to develop breast cancer.

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<sup>4</sup> SEER Cancer Statistics Review 1975-2001. National Cancer Institute.

[http://seer.cancer.gov/csr/1975\\_2001/results\\_merged/topic\\_inc\\_mor\\_trends.pdf](http://seer.cancer.gov/csr/1975_2001/results_merged/topic_inc_mor_trends.pdf)

- Women who received radiation therapy for benign breast disease, mastitis, and Hodgkin's lymphoma all had elevated incidence of breast cancer.

### **What are the most common sources of ionizing radiation exposure?**

Exposure to ionizing radiation occurs during medical and dental x-rays, computed tomography (CT) scans, fluoroscopy and other imaging procedures. CT scans are a particular concern because they deliver a much higher radiation dose than conventional x-rays. CT scans account for just 10 percent of radiologic procedures in the U.S. but contribute an estimated 65 percent of the radiation dose from all medical imaging procedures.

Fluoroscopy is another major source of medical radiation exposure because it involves potentially high-dose exposure lasting from minutes to hours. Physicians in specialties other than radiology, for example, cardiology, gastroenterology, and surgery use fluoroscopy for both diagnostic and therapeutic purposes. Prompted by a growing number of reports to the Food & Drug Administration of radiation-induced burns as well as the potential increase in cancer risk, the Society for Cardiac Angiography (SCAI) and other cardiovascular societies issued a "New Blueprint for Safer Imaging." These voluntary guidelines call for increased physician education on radiation risk and patient safety during fluoroscopy.<sup>5</sup>

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<sup>5</sup> Hirshfeld JW, Balter S., Brinker JA, Kern MJ, Klein LW, Linddsay BD, Tommaso CL, Tracy CM, and Wagner LK. ACCF/AHA/HRS/SCAI clinical competence statement on optimizing patient safety and image quality in fluoroscopically guided invasive cardiovascular procedures: a report of the American College of Cardiology Foundation/American Heart Association/American College of Physicians Task Force on Clinical Competence (ACCF/AHA/HRS/SCAI Writing Committee to Develop a Clinical Competence Statement on Fluoroscopy). Journal of the American College of Cardiology 2004;44:2259-2282. [www.scai.org](http://www.scai.org)

Other sources of radiation include nuclear fallout, radionuclides in drinking water, and radon, a naturally occurring gas.

**There is no safe dose of radiation, and the genetic damage inflicted by radiation is cumulative over a lifetime.** Multiple exposures over time to low-dose radiation may cause the same harm as a single high-dose exposure. According to the National Cancer Institute, infants and children are uniquely vulnerable to the harmful effects of radiation exposure. An estimated 2 to 3 million CT scans are performed annually on U.S. children. Experts estimate that CT radiation exposure can be cut by 50 percent during examination of children without sacrificing diagnostic information. Although there is always risk involved in exposure to radiation, risk appears to decline after age 40.

### **What is one of the most important ways to reduce exposure to radiation?**

Medical and dental radiation accounts for an estimated 55 percent of all radiation exposure. Therefore it is critical to reduce exposure for each and every radiologic procedure to the lowest possible level without sacrificing diagnostic information. This is known as the ALARA (As Low As Reasonably Achievable) principle. Employing the ALARA principle would greatly reduce the risk of breast cancer and other cancers. As the SCAI document states, “This principle confers a responsibility on all physicians to minimize the radiation injury hazard to their patients, to their professional staff, and to themselves.” In mammography, for example, implementing the ALARA principle has reduced the radiation dose from an estimated two rads in 1976 to 0.2 rads today.<sup>6</sup>

Assembly Bill 000 is an important first step in educating health professionals and the public regarding radiation risks and how to reduce exposure. This legislation requires the California Department of Health Services to:

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<sup>6</sup> Bailar JC III (1976). Mammography: A contrary view. *Annals of Internal Medicine* 84:77-84.

- Develop a radiation awareness poster and disseminate it to hospitals to post in waiting rooms, examination rooms, or other public areas.
- Develop a Radiation Awareness section on their website that includes a downloadable x-ray card and brochure in both Spanish and English.
- Convene an advisory panel of experts in radiology and public health, and consumer advocates to provide recommendations to the legislature and the DHS by June 2007 on:
  - Standards for measuring and tracking radiation dosage for each diagnostic patient procedure.
  - Improving provider and patient awareness of the risks of radiation exposure.

Passage of Assembly Bill 000 will once again make California a leader in protecting public health and safety.

(Sidebar on mammography)

## **Mammograms And Radiation Exposure**

Mammograms are the most widely available screening method for breast cancer, even though they expose women to radiation. Understanding and weighing the risks and benefits can be difficult.

Recognizing this quandary, Breast Cancer Fund encourages women to make informed decisions about the timing and frequency of mammograms for their individual circumstances and to consider other options when they become available.

BCF applauds successful efforts to reduce radiation exposure from mammograms, as mandated by the Mammography Quality Standards Act and we encourage ongoing reduction of all medical radiation exposure.

Mammography is only one of many imaging procedures that expose the breast to radiation. Radiologic imaging of the spine, heart, lungs, ribs, shoulders, and esophagus also exposes parts of the breast to radiation.